shock or other inconvenience of any kind was experienced by the inmates of the house, with the exception of the consternation produced by the deafening sound of the stroke.

The President suggested that the blackening of the wall may have been produced by the combustion of the wire, and its dissipation in the form of the black oxide of copper.

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The President gave an account of some experiments made by him in electro-magnetism.

The discovery of the electro-magnet induced hopes that it might be advantageously employed as a moving power, and numerous attempts to effect this have been made. But though probably it cannot be used economically for this purpose, yet many cases occur where cost is but a secondary consideration, and where an electro-magnetic machine would be highly convenient. In reference to them, his friend, Mr. Bergin, had endeavoured to construct one suited to the wants of the laboratory or workshop, and in the course of his experiments had consulted Dr. Robinson as to the conditions of current helices, &c., which would produce a given power with least expenditure of battery materials. On these heads he was surprised to find how little is known, and commenced experimenting to instruct himself, and he offers the results which he found, as useful to the practical magnetician, but still more (which was his chief object in pursuing them so far) as offering useful data to those who, like Professor William Thomson, of Glasgow, are engaged in investigating the theory of magnetic induction.

Without intending to enter on that theory, he pointed out the conditions of electro-magnetic excitation, indicated the existence of the coercive force in iron, and explained its agency in producing the permanent magnetism, and another state, which he terms residual excitation,—that, namely, in virtue of which an electro-magnet, which has been excited, continues to attract its keeper even when the current is cut off.

His researches extended to—

1. The relation between a magnet's power and the intensity of the current passing through its helices.

2. The effect of the distribution and number of its spires of wire.

3. That of the unexcited portion of the magnetic circuit.

4. That of the material, iron, or hard steel; and—

5. The influence of the length and diameter of the magnet.

The present communication referred to the first only; the others being reserved for future occasions.

He then described his apparatus.

The electro-magnet consisted of two cylinders of soft iron, 2 inches diameter, and 12 long, fixed on an iron base, 6 inches asunder. On these were placed helices of the same length, containing 638 turns of lapped copper wire, No. 12; the magnet weighs 26 lbs., and its keeper 7. The attractive force is measured by a weighing machine, composed of two levers, the lower of which acts as a steel-yard. The ratio of its leverage is nearly 60, and it can be depended on to $\frac{1}{2000}$ of the load weighed.

The currents were measured by a tangent Rheometer, whose construction was detailed; its needle's length is $\frac{1}{9}$ of the diameter of its circular conductor, and its law was verified by the voltameter up to a deflection of 72°.

They were equalized by a new Rheostat, which he had formerly exhibited to the Academy, and of which he gave some further details. The variable wire is palladium, and it is surrounded by water, both to cool it and to give a measure of its temperature. Unless a correction be applied for that change of resistance, which depends on heat, he thought no rheostat measures are to be trusted. As approximations to the resistance of this wire, he gave that, assuming his unit of current to be that which decomposes a grain of water in five minutes, the intensity of a Grove's cell is 47.28 inches of it. He gave another in terms of the electrolytic intensity of water, stating, however, the uncertainty which attaches to this latter mea-

sure. It is not affected by the quantity of acid in the electrolyte, or the size of the electrodes; it is by heat, and by the intensity of the battery. The latter, however, he regarded as only an apparent error, but had not yet fully investigated it.

The results which he obtained were exhibited in a tabular form, giving the lifting power, the residual magnetism, and the residual excitation for 35 different currents from 0.04 to 6.85.

The first of these is influenced by various circumstances.

1. A magnet requires its load to be gradually increased.

2. It requires time for the full development of its power; with the highest current used, not less than five minutes; with the lower, fifteen.

3. Like permanent magnets, its power is diminished by temperature. He found that in this one the reduction is 0.00033 for each degree above 60°.

4. It is influenced by the molecular change which produces permanent magnetism, being greatest when that is least.

It is not proportional in any part of the range included by these experiments to the intensity of the exciting current, and the ratio between them decreases very rapidly as the latter is increased. From this fact it follows, that a magnet has a limit beyond which its power cannot go, in this one probably under 1000 lbs. A current 1 enables it to lift 500 lbs., and one of 6.85 only 775. When the magnet has acquired permanent magnetism, a feeble negative current (in the opposite direction) will not destroy that condition, nor change the usual direction of the polarity, but merely lessen the lift. With higher powers these effects do take place; but the negative lifts are less than the other until they amount to half the maximum (a point which seems critical in electro-magnetism). This degree of excitation should, therefore, be used in all machines when the polarity is to be reversed.

The maximum residual magnetism observed in this magnet is 8.88 lbs., but in general only 4.44. By long excitation its molecular constitution is sometimes disturbed, so that this quantity is thus increased, but it recovers by rest.

The residual excitation, or power which remains after excitation has ceased, is always of the same amount, 130.68, if that would have passed half the maximum; below that it bears a continually increasing ratio to the full power till it becomes two-thirds of it. If, while the magnet is in this state, a current that would of itself produce the same lift be passed, the effect is not doubled, but only increased by one-third. A negative current, if powerful, destroys this condition; if feeble, only lessens it.

The least current which he has tried, 0.0008, excites the magnet, and even changes its residual magnetism.

MONDAY, JUNE 28TH, 1852.

THOMAS ROMNEY ROBINSON, D. D., PRESIDENT, in the Chair.

MR. BERGIN read a paper on the illumination of objects in the microscope.

"All who are accustomed to the use of the microscope are necessarily aware of the vast improvements which have been effected within the last twenty years or little more. Prior to that, the compound microscope was almost worthless as an instrument of research, and inquiries as to minute structures were carried on by means of single lenses, or of combinations acting as single lenses: and when we look to the works remaining to us of the earlier microscopic observers, as Leeuwenhoek, Grew, Malpighi, and others, it is truly wonderful what they effected. However, the labour of such investigations with such means, or even with the jewel lenses of Pritchard, the doublets of Wollaston, or the triplets of Holland, was, as every one who has used them well knows, immense, and the injury to the sight caused by high powers unfortunately very great and enduring. All this, however, has been so amply and ably treated